

CLAIMS

What is claimed is:

1. A tube-forming device comprising:
 - a) a work piece holder to receive a tubular work piece;
 - b) a tool insertable into an end of the tubular work piece held by the work piece holder;
 - c) a tool holder to receive the tool and movable in first and second directions;
 - d) a first cam to drive the tool holder in a first direction during a first phase of a tool cycle to engage the tool with a first side of the work piece; and
 - e) a second cam driven synchronously with the first cam to drive the tool holder in a second direction during a second phase of the tool cycle to engage the tool with a second side of the work piece.
2. The tube-forming device of claim 1 wherein the work piece holder comprises a die block having an opening therein to receive the work piece.
3. The tube-forming device of claim 2 wherein the work piece holder further comprises an interchangeable die insertable into the opening in the die block.
4. The tube-forming device of claim 3 wherein the die comprises a sleeve that surrounds the work piece.
5. The tube-forming device of claim 4 wherein the die further comprises a cutting edge that cooperates with the tool to shear the work piece.

6. The tube-forming device of claim 1 wherein the tool comprises a shear.
7. The tube-forming device of claim 6 wherein the shear is shaped to notch the end of the work piece.
8. The tube-forming device of claim 1 wherein the tool comprises a piercing tool to form an opening in the work piece.
9. The tube-forming device of claim 1 further comprising a plurality of interchangeable tools.
10. The tube-forming device of claim 1 wherein the tool holder comprises a reciprocating carrier block having an opening therein to receive the tool.
11. The tube-forming device of claim 10 wherein the carrier block has first and second cam openings therein adapted to receive the first and second cams respectively.
12. The tube-forming device of claim 11 wherein the first cam opening has a first cam surface engaged by the first cam during a first phase of the tool cycle to move the carrier block in a first direction and wherein the second cam opening has a second cam surface engaged by the second cam during a second phase of the tool cycle to move the carrier block in a second direction.
13. The tube-forming device of claim 1 further comprising biasing means to bias the carrier block to a neutral position in which the tool is centered with respect to the work piece.

14. The tube-forming device of claim 13 wherein the biasing means comprises at least one spring that presses against the carrier block.

15. A tube-forming device comprising:

a) a work piece holder to receive a tubular work piece;

b) a tool insertable into an end of the tubular work piece held by the work piece holder;

c) a tool holder to receive the tool and movable in first and second directions; and

d) a dual action cam assembly to drive the tool holder in first direction during a first phase of a tool cycle to engage the tool with a first side of the work piece, and to drive the tool holder in a second direction during a second phase of the tool cycle to engage the tool with a second side of the work piece.

16. The tube-forming device of claim 15 wherein the work piece holder comprises a die block having an opening therein to receive the work piece.

17. The tube-forming device of claim 16 wherein the work piece holder further comprises an interchangeable die insertable into the opening in the die block.

18. The tube-forming device of claim 17 wherein the die comprises a sleeve that surrounds the work piece.

19. The tube-forming device of claim 18 wherein the die further comprises a cutting edge that cooperates with the tool to shear the work piece.

20. The tube-forming device of claim 15 wherein the tool comprises a shear.

21. The tube-forming device of claim 20 wherein the shear is shaped to notch the end of the work piece.

22. The tube-forming device of claim 15 wherein the tool comprises a piercing tool to form an opening in the work piece.

23. The tube-forming device of claim 15 further comprising a plurality of interchangeable tools.

24. The tube-forming device of claim 15 wherein the tool holder comprises a reciprocating carrier block having an opening therein to receive the tool.

25. The tube-forming device of claim 24 wherein the carrier block has first and second cam openings therein adapted to receive the first and second cams respectively.

26. The tube-forming device of claim 25 wherein the first cam opening has a first cam surface engaged by the first cam during a first phase of the tool cycle to move the carrier block in a first direction and wherein the second cam opening has a second cam surface engaged by the second cam during a second phase of the tool cycle to move the carrier block in a second direction.

27. The tube-forming device of claim 15 further comprising biasing means to bias the carrier block to a neutral position in which the tool is centered with respect to the work piece.

28. The tube-forming device of claim 27 wherein the biasing means comprises at least one spring that presses against the carrier block.

29. The tube-forming device of claim 15 wherein the dual action cam assembly comprises a first cam to drive the tool holder in first direction during a first phase of a tool cycle to engage the tool with a first side of the work piece and a second cam to drive the tool holder in second direction during a second phase of a tool cycle to engage the tool with a second side of the work piece.

30. A method of forming the end of a tubular work piece comprising:

a) inserting a work piece into a work piece holder such that the work piece inserts over a tool;

b) rotating a dual action cam assembly to reciprocate the tool during a tool cycle;

c) wherein during a first phase of the tool cycle, the tool is driven in a first direction by the cam assembly to engage a first side of the tubular work piece; and

d) wherein during a second phase of the tool cycle, the tool is driven in a second direction by the cam assembly to engage a second side of the tubular work piece.

31. The method of claim 30 wherein the tool is idle during a third phase of the tool cycle to allow a work piece to be inserted into the work piece holder.